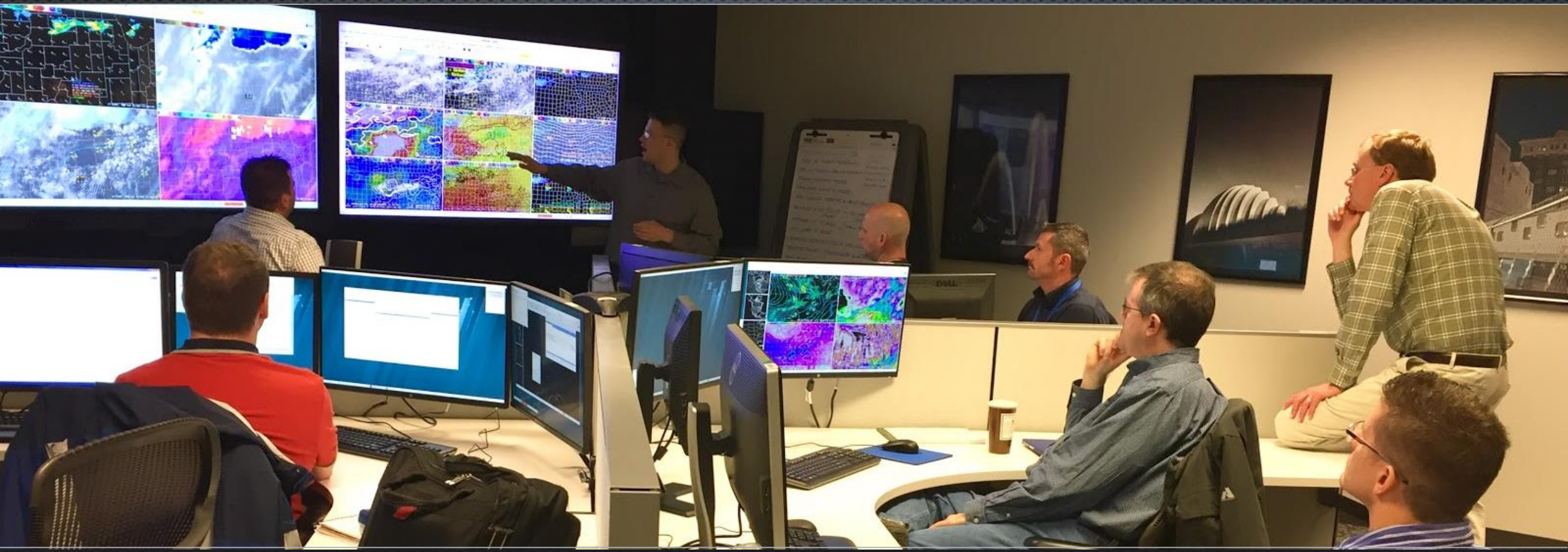
The Role of Expert Mesoanalyst in Collaborative Severe Weather IDSS



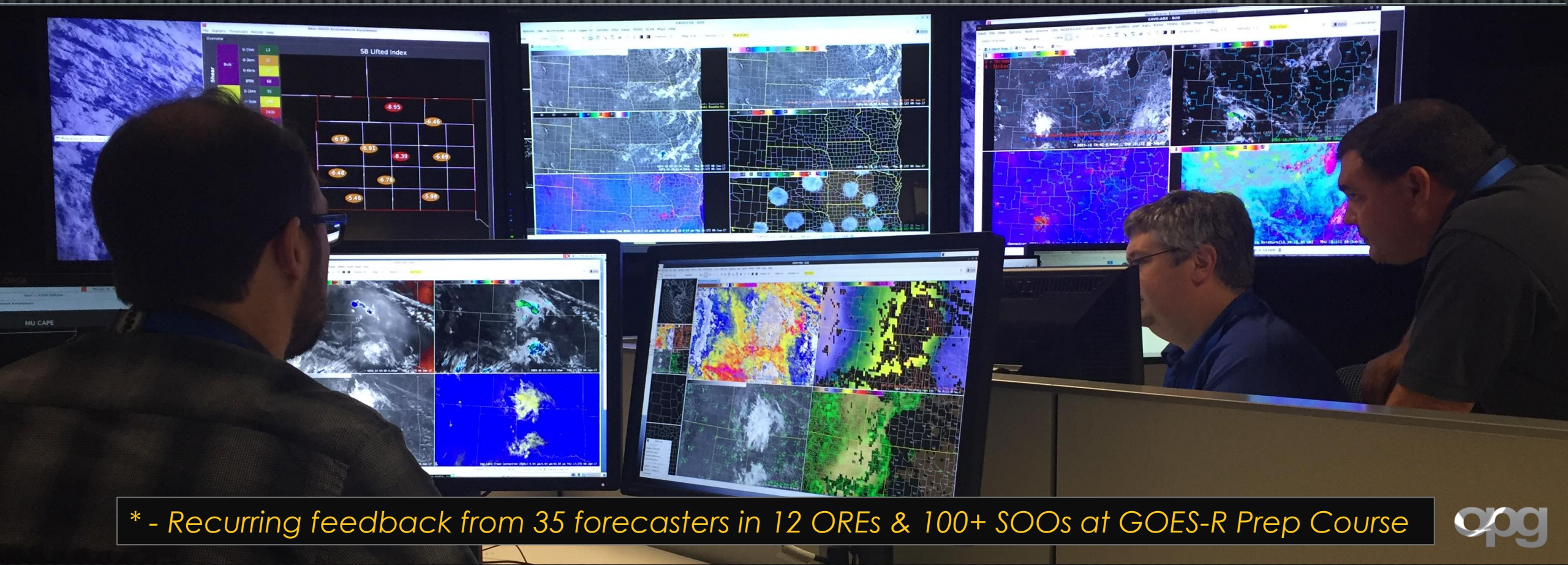
☆ VLAB FORUM - WEDNESDAY, OCTOBER 16, 2019 ☆

Kim Runk, Director
Operations Proving Ground

Background: A Growing Problem

Difficulty managing increasing volume of high-res data sets

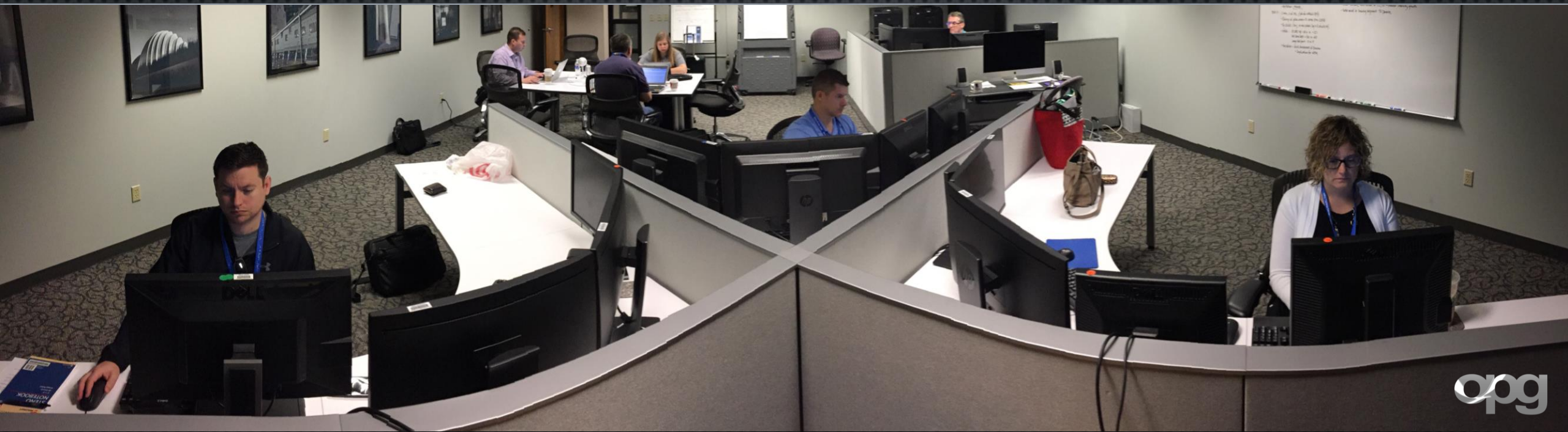
Mesoanalyst role is often underutilized in high impact Events *



* - Recurring feedback from 35 forecasters in 12 OREs & 100+ SOOs at GOES-R Prep Course

Background: A Potential Solution

- Champion the potential value of expert mesoanalysis
- Improve targeted IDSS in watch/warning gap
- Promote more effective SPC-WFO collaboration
- Conduct Collaborative Proof-of-Concept Evaluations



The 2018 Mesoanalysis Think Tank

Gathered expert convective mesoanalysts in Kansas City for 3 days

Identified science/services gaps & best practices for convective IDSS

Documented 5 findings & recommendations; forwarded to NWSH

Mesoanalysis Today

Mesoanalyst/Radar Support

1. Conduct analysis of synoptic, mesoscale, and near-storm environment; communicate key insights and observations to radar operator.
2. Issue Mesoscale AFD(s) to describe expectations regarding initiation, timing, location, severity, coverage, storm mode, and threats.
3. Provide updates on NWSChat when significant changes in storm mode or warning thresholds are anticipated.
4. Participate in any SPC watch coordination discussions.
5. Provide radar briefings and updates over MERS and to SkyWarn hams, if present.
6. Assist the Warning Forecaster(s) in any mission critical aid needed (e.g., monitor web cams, serve as second pair of eyes on radar, etc.)

Some key features to include on thunderstorm composite charts

1. Instability **CAPE, LI (Orange)**
2. Lift **700mb Omega (Brown)**
3. Moisture **Dewpoints SFC or 850mb (Green)**
4. CAP CIN or 700mb temps (Grey)
5. Shear **SRH or BRN shear (Yellow)**
6. Forcing **SFC or elevated boundaries**

Severe Weather Indices

Instability	Low	Moderate	High	Extreme
CAPE	<1000	1000-2500	2500-3500	>3500
LI	0 to -3	-3 to -5	-6 to -9	<-9
Showalter	-1 to -2	-2 to -3	-4 to -6	<-6
CIN	>150	100-149	50-99	<50
LCL	1500m	1250-1499m	1000-1249m	<1000m
LFC	>2500m	2000-2499m	1500-1999m	<1500m

Wind Shear	Poor	Marginal	Favors	Strong
0-1km EHI	<1.0	1.0-1.9	2.0-2.9	>=3.0
0-6km shear	<30kt	30-37kt	38-44kt	>45kt
ESREH	<150	150-299	300-449	>450
BRN Shear	35-45	45-55	55-65	>65
Eff Bulk Shear	<25kt	25-30kt	30-40kt	>40kt

Bulk Richardson Number

<10--High shear, low CAPE. Shear may be too strong to allow strong upright convection.
10-45--Associated with supercells.
>50--Weak shear, high CAPE. Multicells likely.

Supercell Composite

3-5 Lower threshold for supercells
5-8 Weak tornadoes
8-10 Significant tornadoes

Significant Tornado Parameter

0.5-1.5 Threshold for supercells
1.5-3.0 Weak tornadoes
3.0+ Significant tornadoes

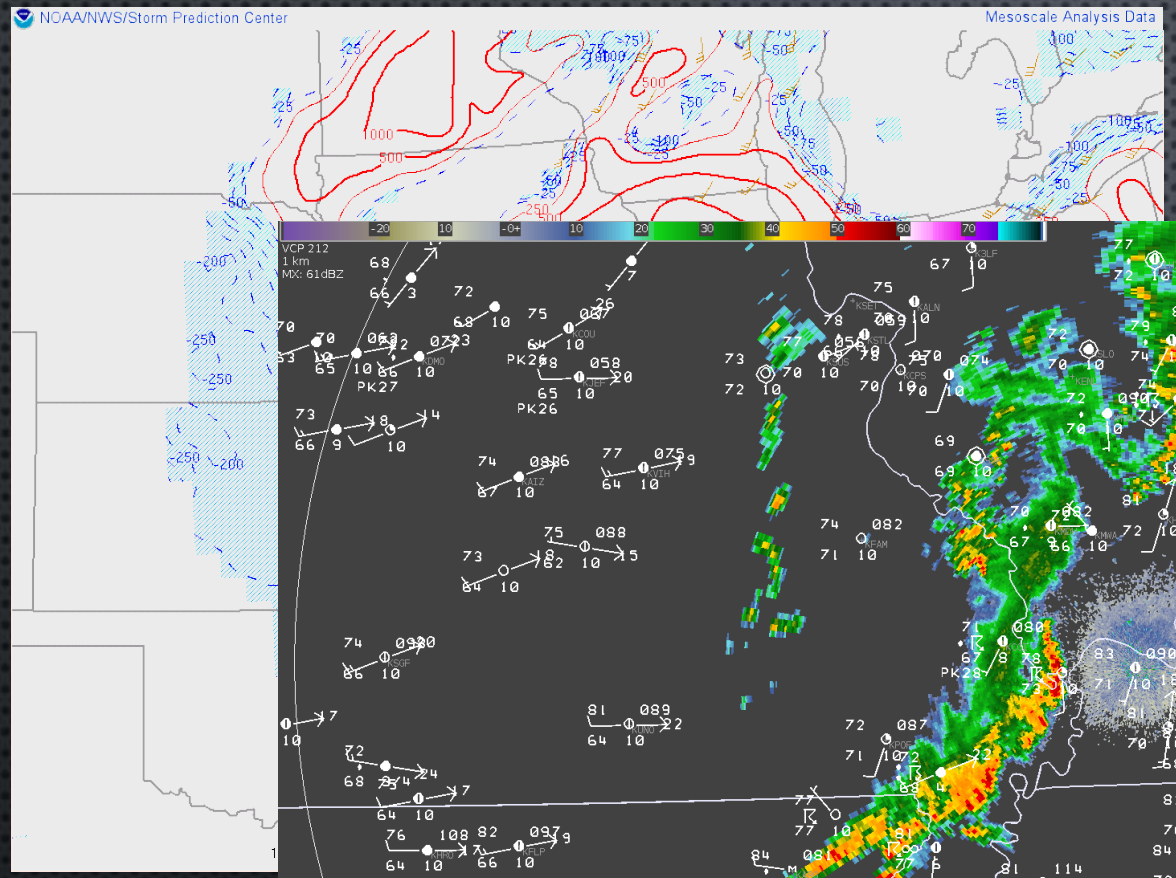
GOES Rapid Scan Operations (RSO)

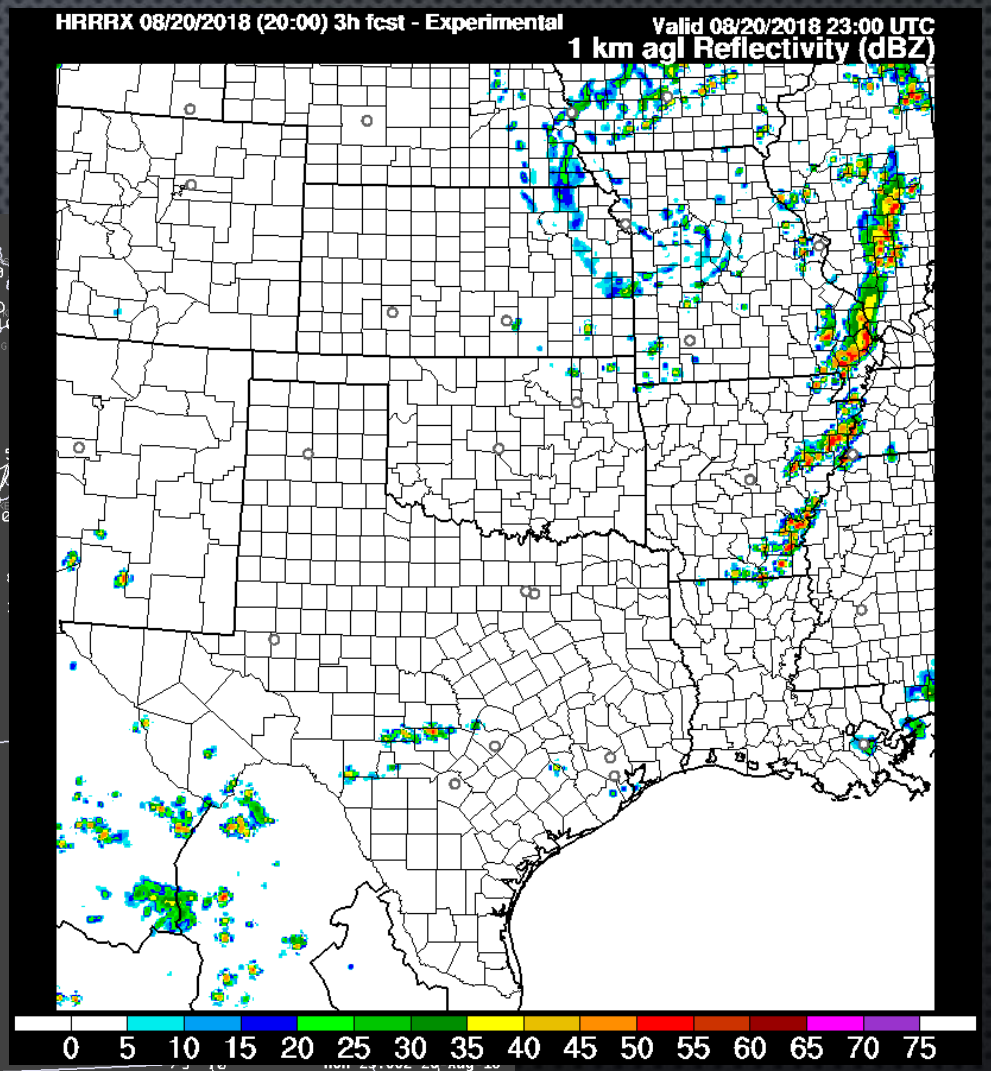
If RSO will be beneficial to warning operations:
1. Call [redacted]
2. Give at least 1 hr. lead time before RSO initiation.
3. Provide Detroit with start and stop time for RSO.

* On Moderate and High Risk days, SPC will make the RSO request [redacted]

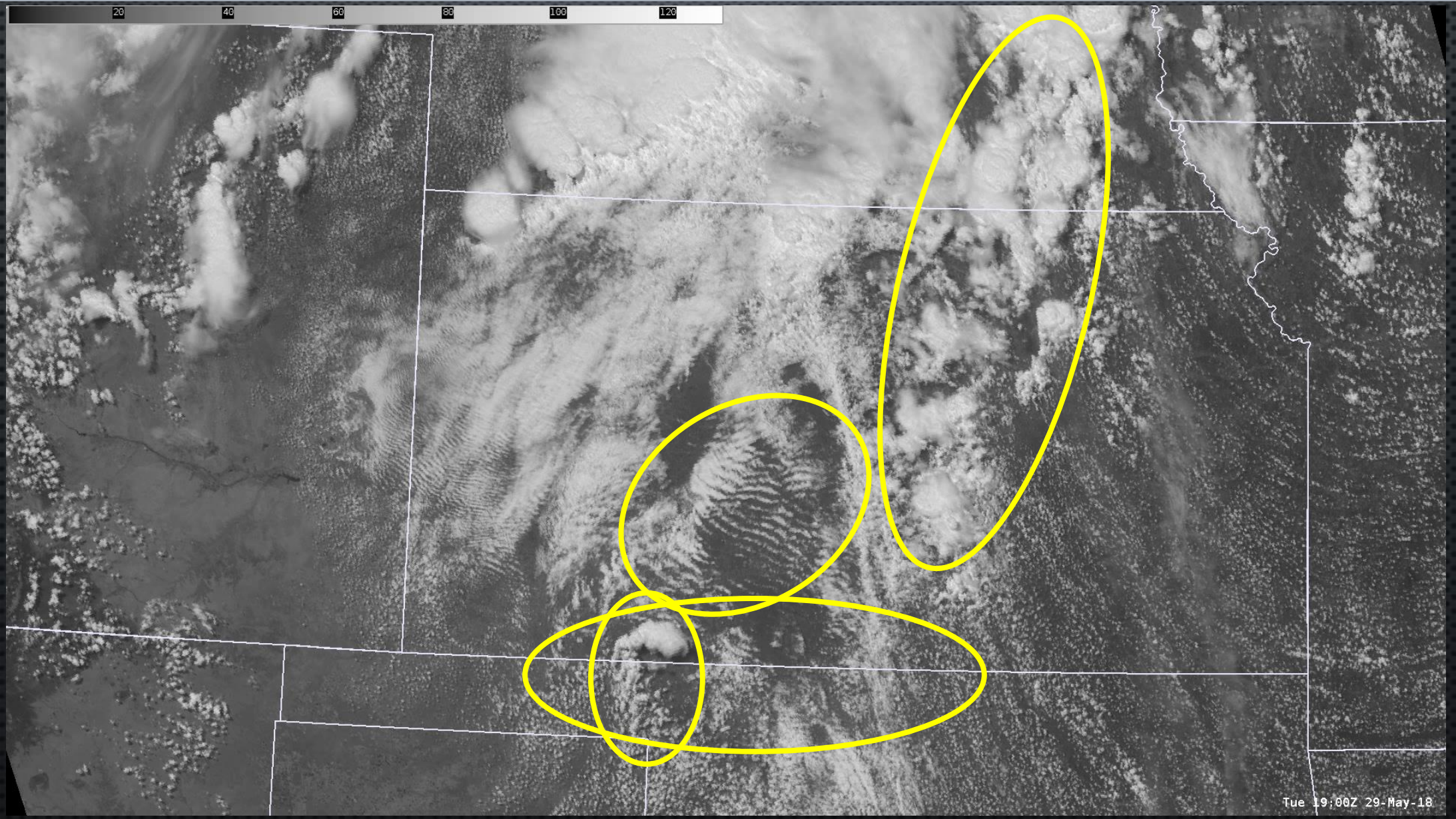
SPC Hourly Mesoscale Analysis **http://spc.noaa.gov/exper/mesoanalysis/**

Mesoanalysis Today

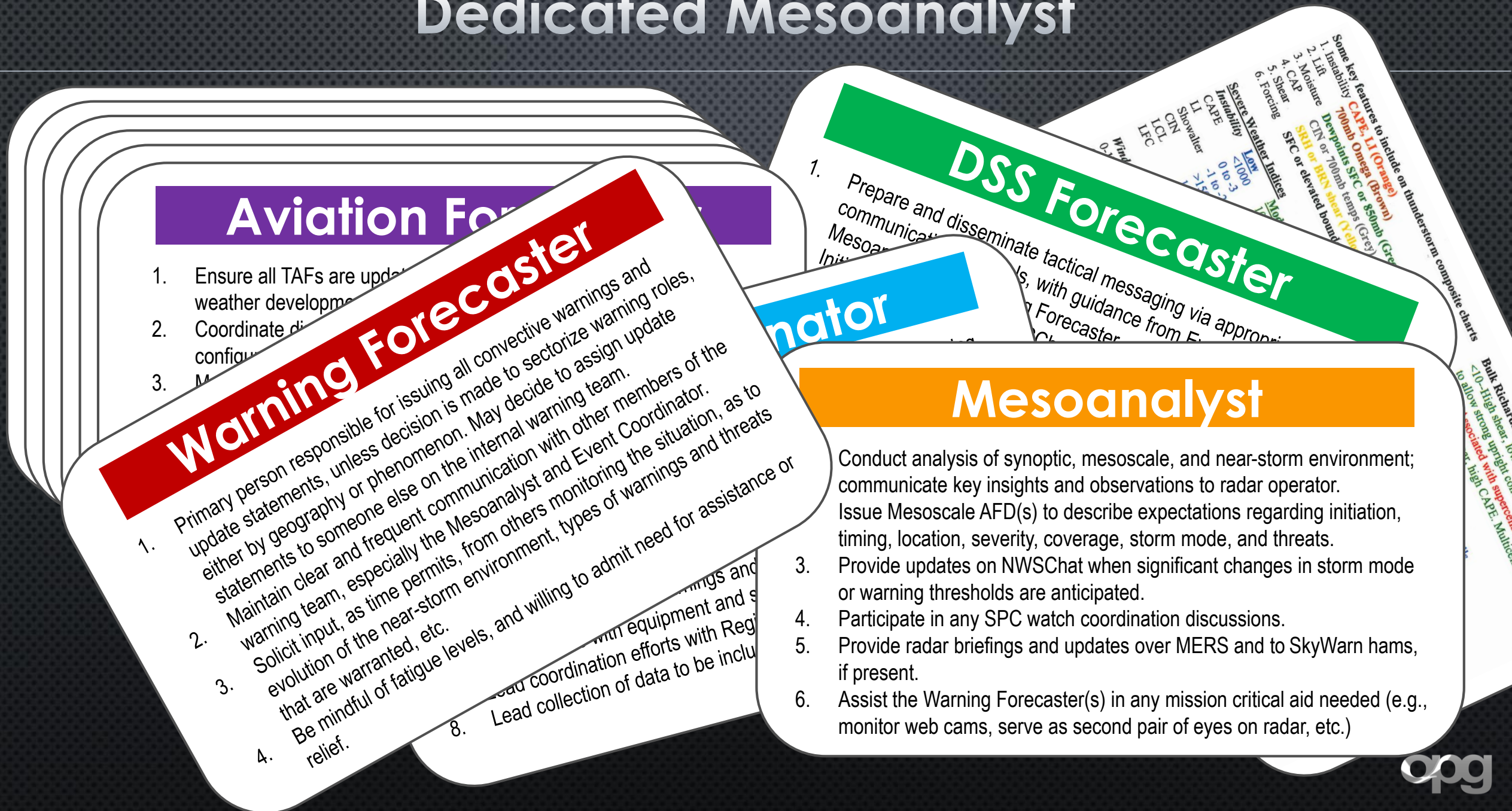




Effective Mesoanalysis Techniques



Dedicated Mesoanalyst



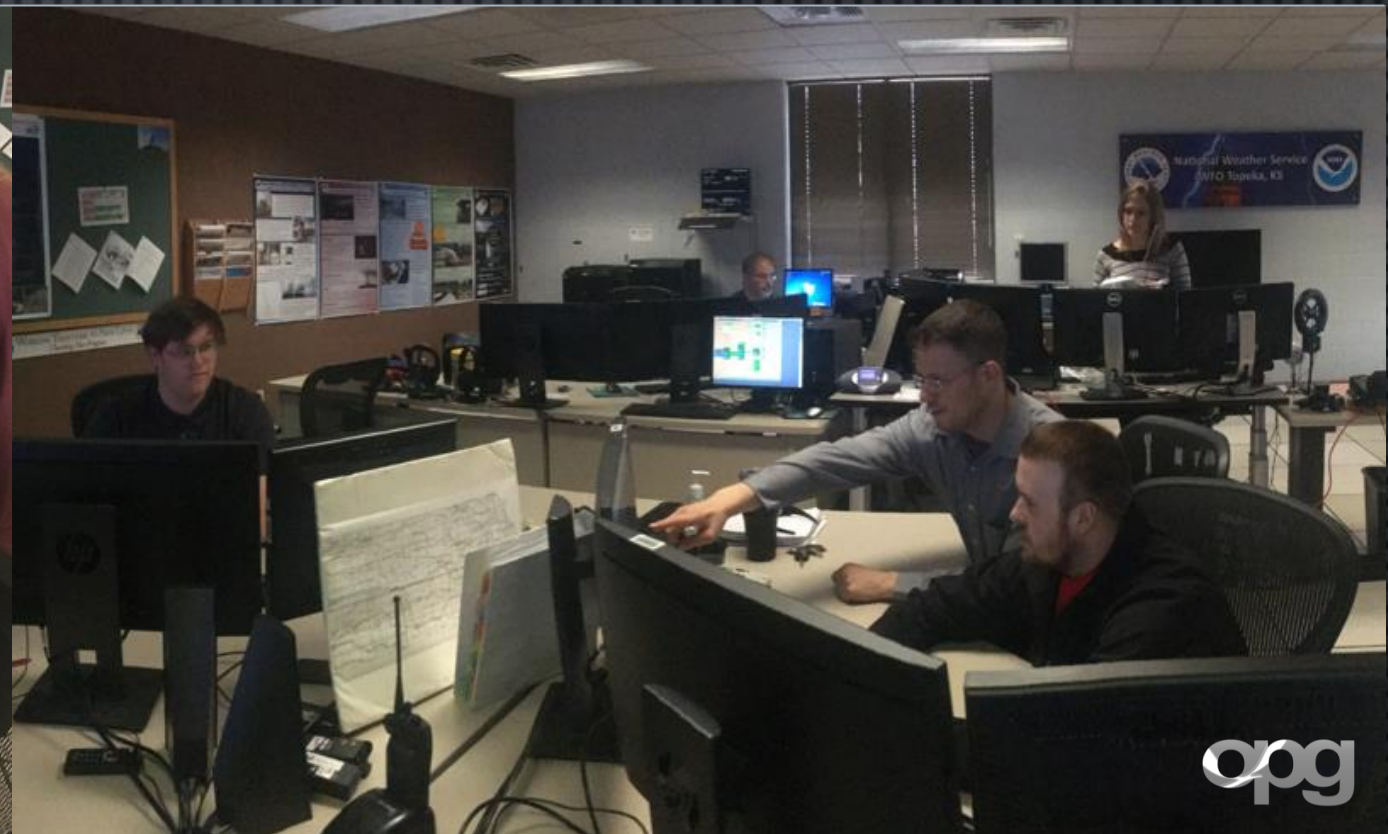
Dedicated Mesoanalyst

Mesoanalyst

1. Conduct analysis of synoptic, mesoscale, and near-storm environment; communicate key insights and observations to radar operator.
2. Issue Mesoscale AFD(s) to describe expectations regarding initiation, timing, location, severity, coverage, storm mode, and threats.
3. Provide updates on NWSChat when significant changes in storm mode or warning thresholds are anticipated.
4. Participate in any SPC watch coordination discussions.
5. Provide radar briefings and updates over MERS and to SkyWarn hams, if present.
6. Assist the Warning Forecaster(s) in any mission critical aid needed (e.g., monitor web cams, serve as second pair of eyes on radar, etc.)

Multiple Benefits

- Enhance situational awareness of NSE
- Continuous flow of tactical information
- Clear, precise, actionable intelligence

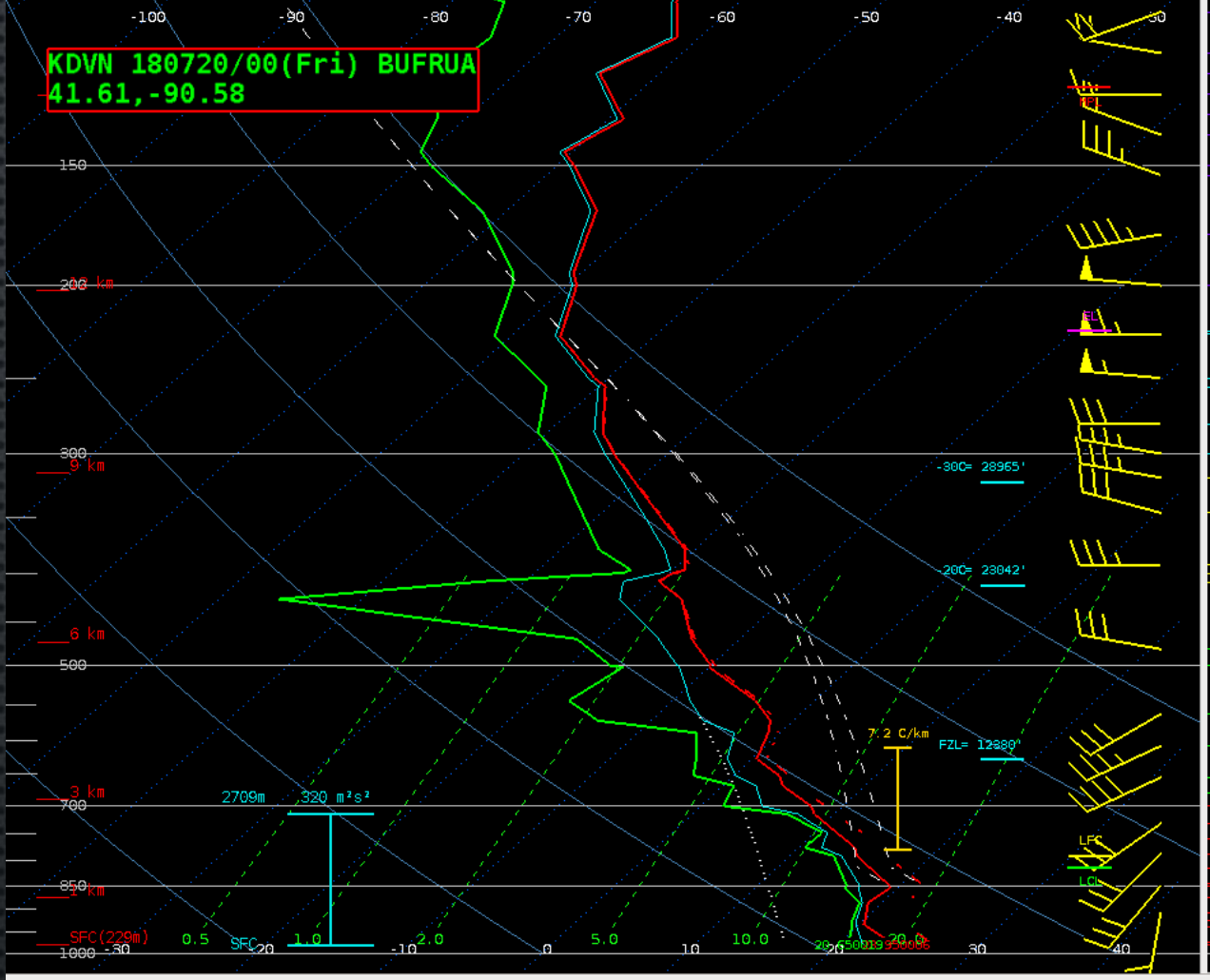


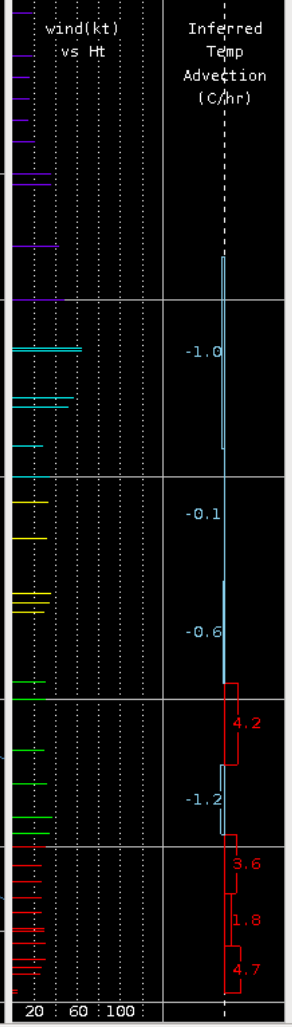
FACETs Challenge

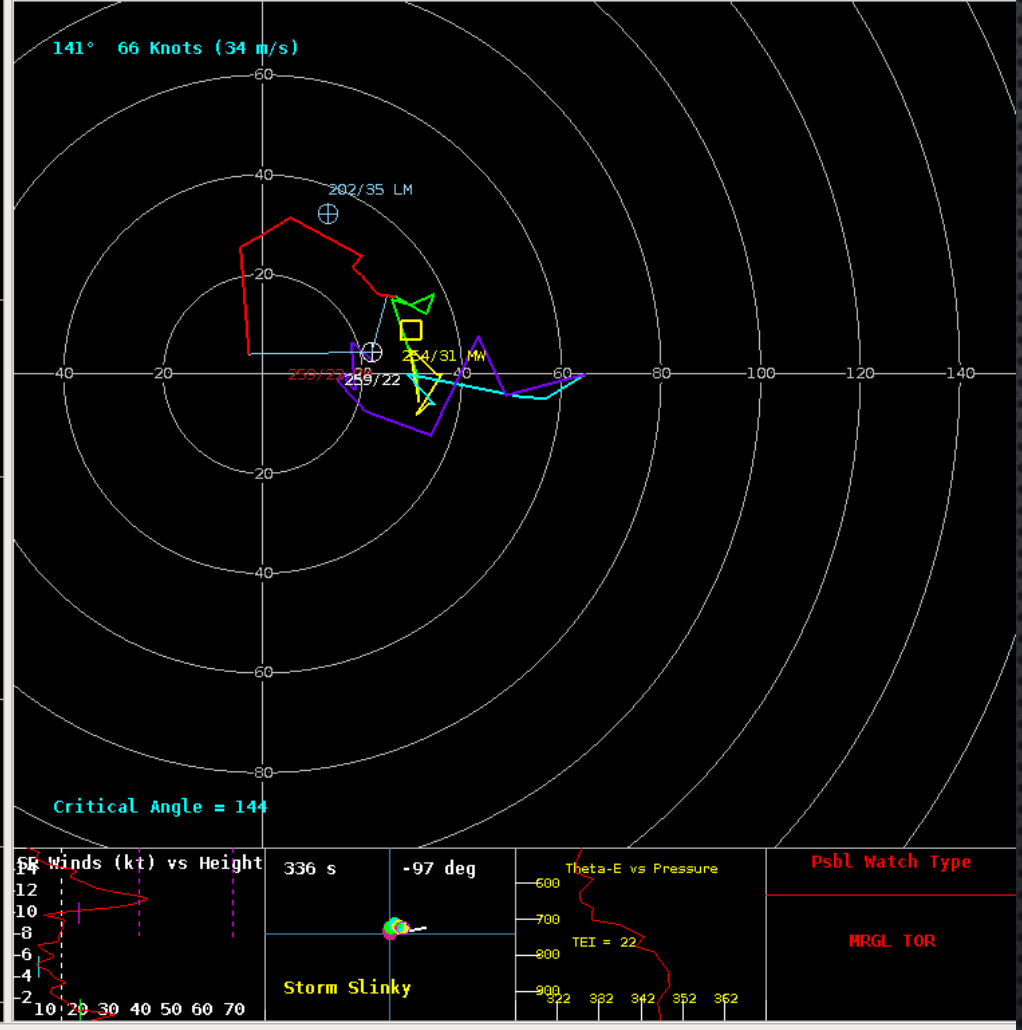
Transition NWS operating model from product-centric, schedule-driven to information-centric, service-driven.

Key characteristic: continuous flow of information with special emphasis on existing gaps (e.g., watch/warning).

Also lends itself to exploring the use of probabilistic space to drive intelligent risk management decisions.





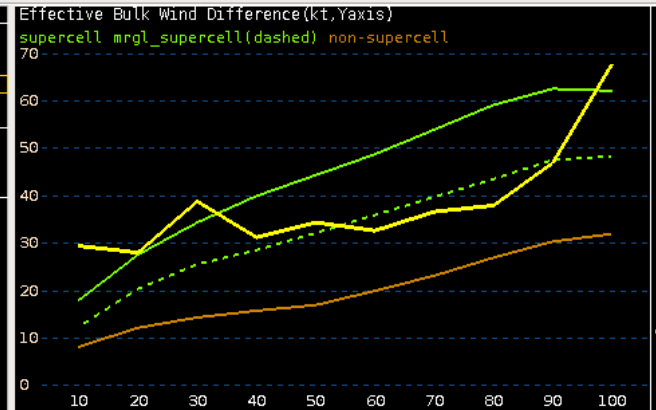


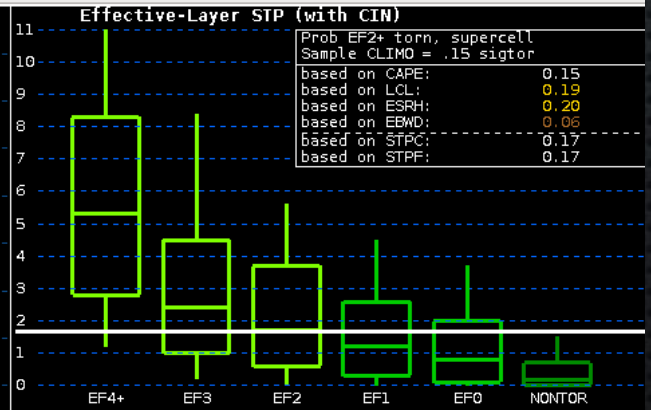
PARCEL	CAPE	CIN	LCL	LI	LFC	EL
SURFACE	1313	-67	427m	-7	2144m	34249'
ML 100 mb	1380	-56	653m	-7	2089m	34249'
FCST SFC	2311	-3	1234m	-9	1600m	39636'
MU (850 mb)	1630	-6	1629m	-8	1861m	37249'
EFF LAYER	1106	-39	1551m	-6	2321m	33498'
USER DEF	1630	-6	1629m	-8	1861m	37249'

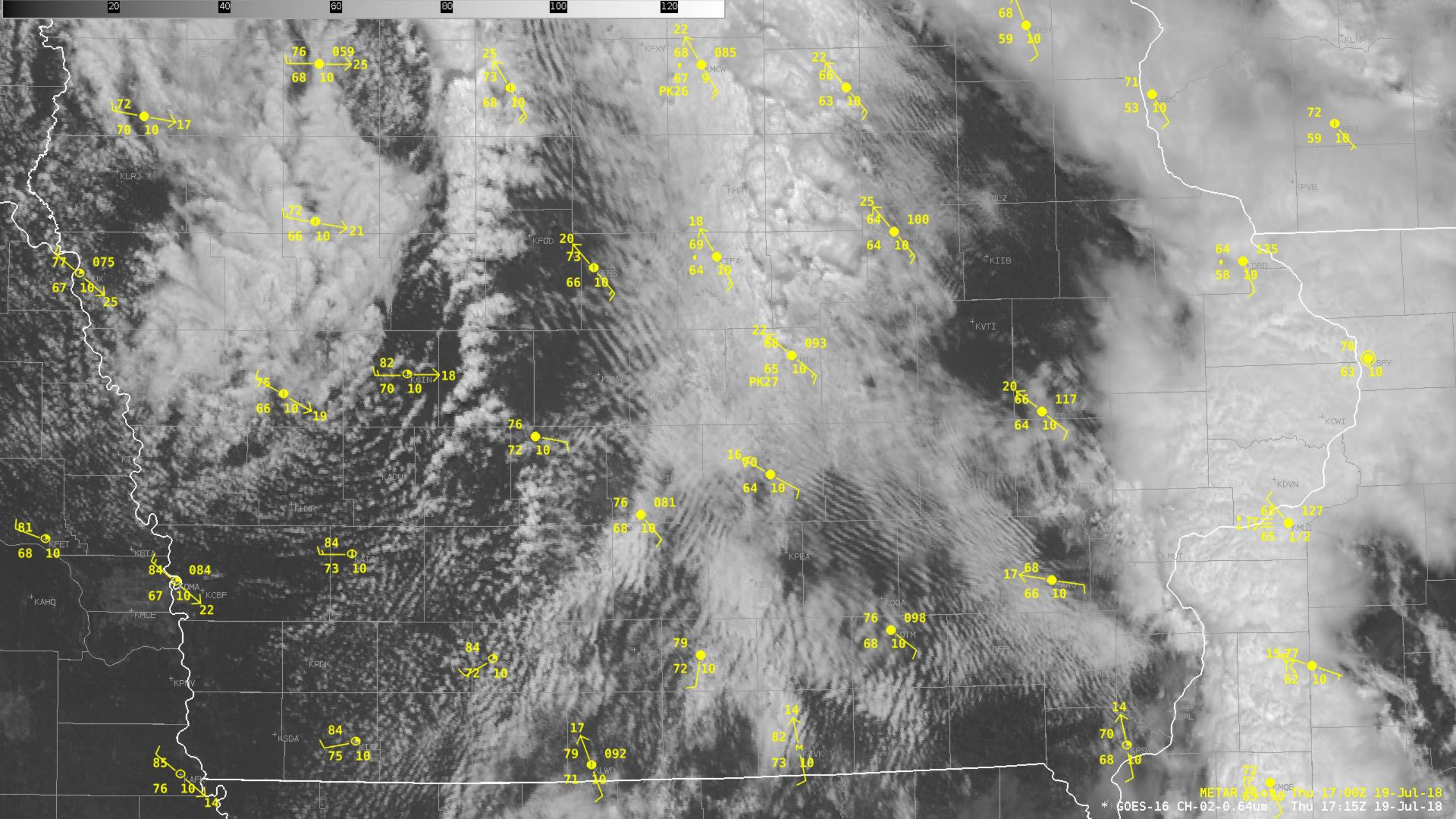
PW = 1.79in	3CAPE = 53J/kg	WBZ = 11277'	WNDG = 0.00
K = 39	DCAPE = 894J/kg	FZL = 12380'	ESP = 0.00
MidRH = 79%	DownT = 61F	ConvT = 87F	MMP = 0.27
LowRH = 85%	MeanW =15.3g/kg	MaxT = 86F	NCAPE =0.17

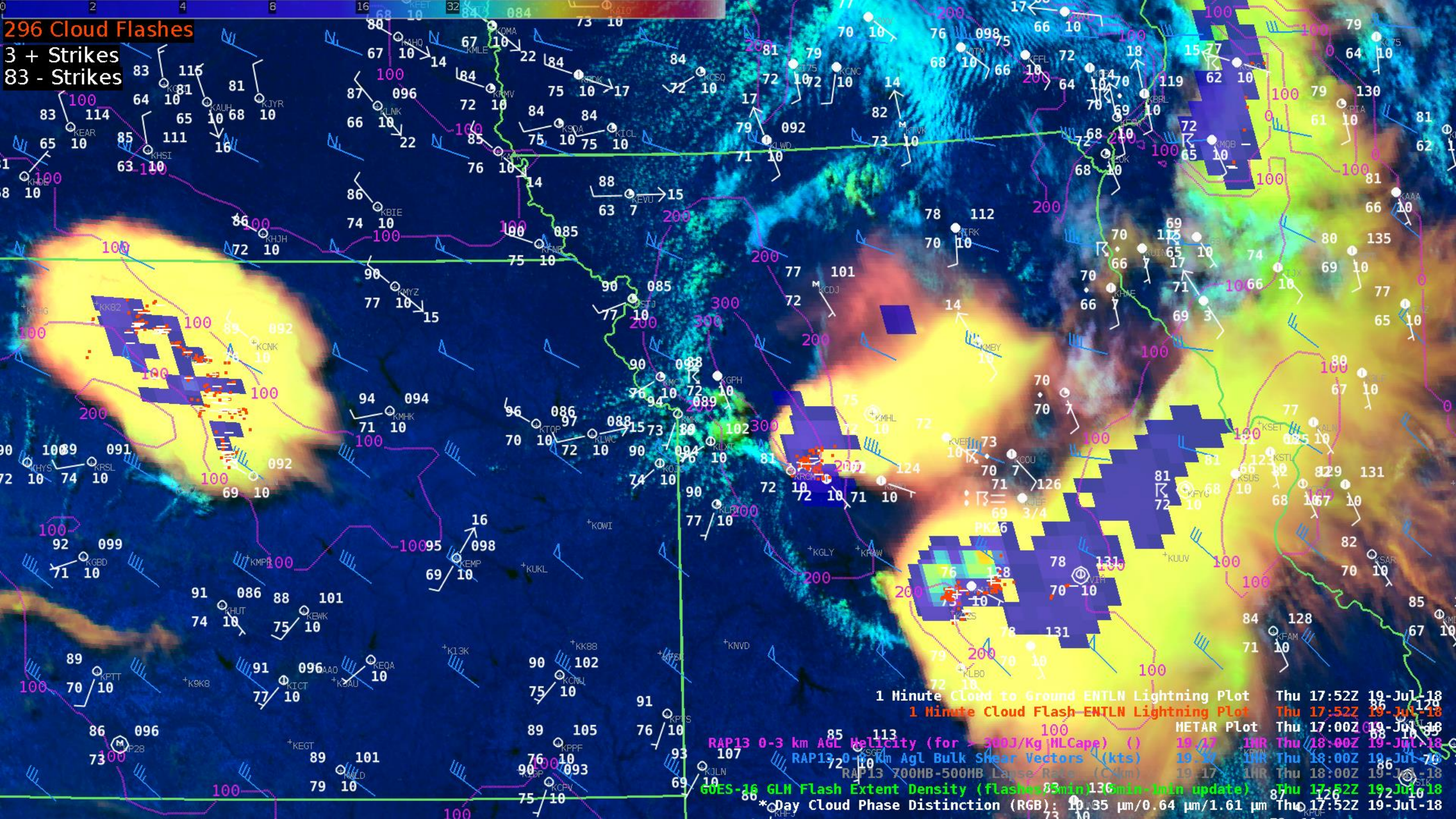
sfc-3km Agl LapseRate=	18C/5.9C/km
3-6km Agl LapseRate=	20C/6.6C/km
850-500mb LapseRate=	30C/6.8C/km
700-500mb LapseRate=	18C/6.6C/km

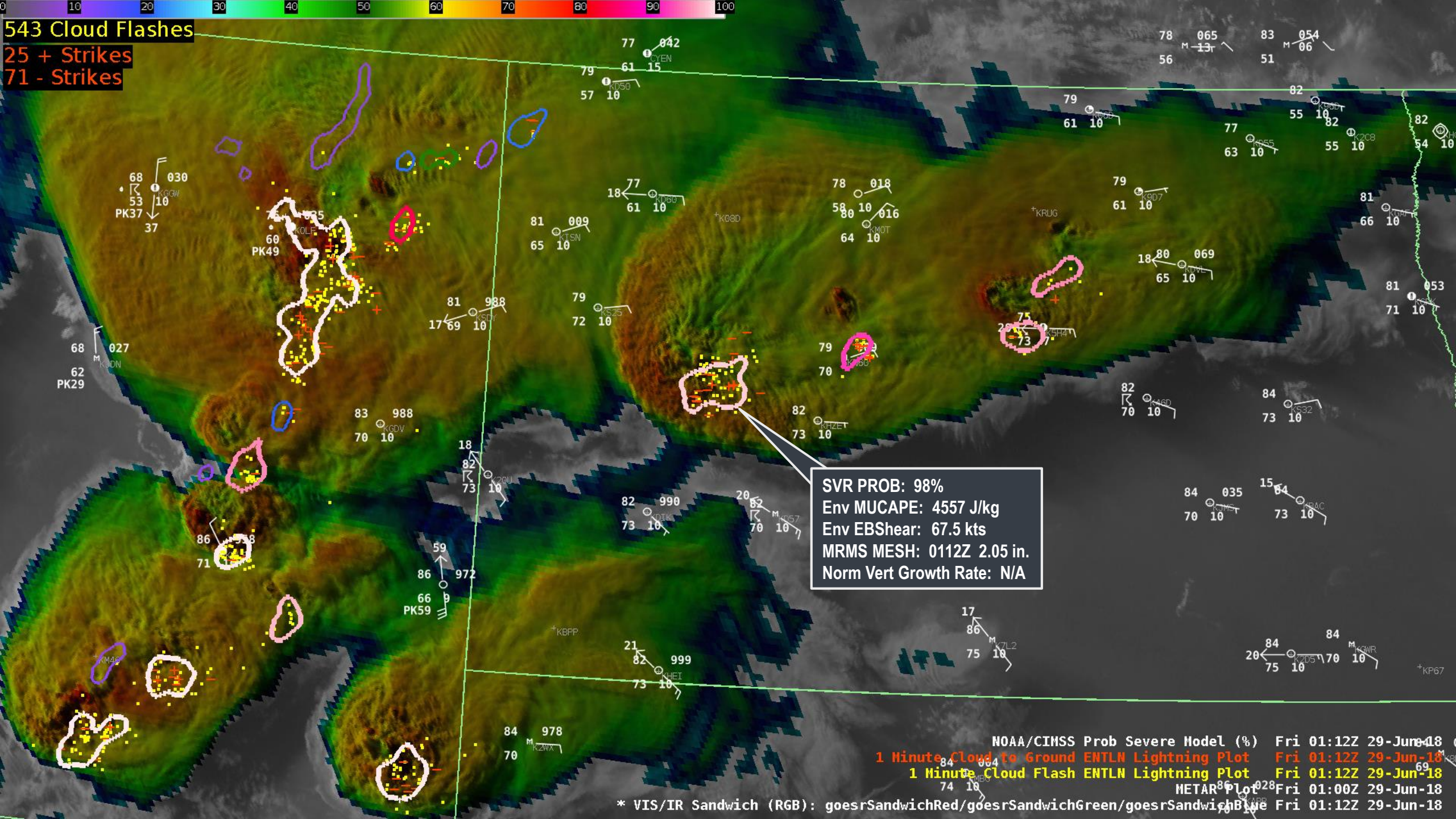
Supercell=	9.0
STP(eff)=	1.7
STP(fixed)=	1.6
SHIP=	0.7



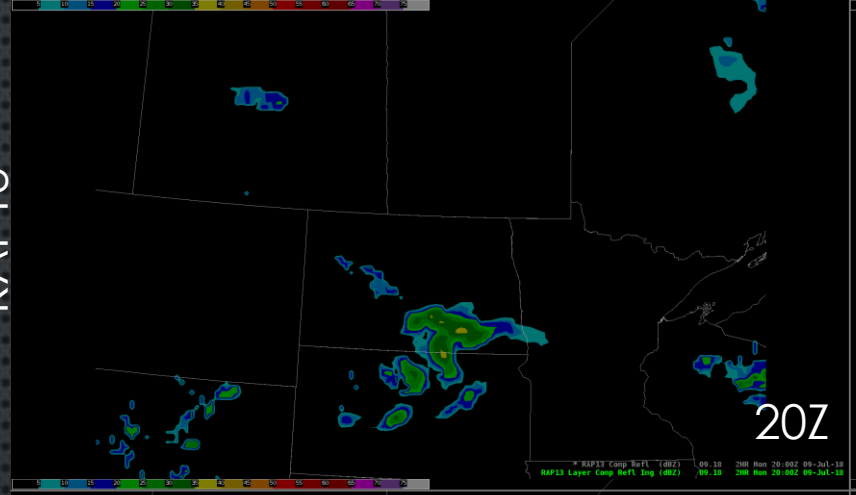


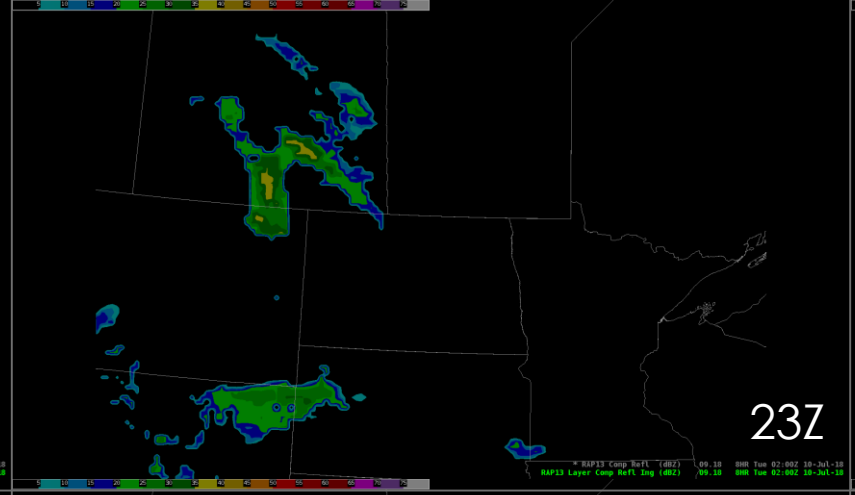

20
40
60
80
100
120
METAR Thu 17:00Z 19-Jul-18
* GOES-16 CH-02-0.64um Thu 17:15Z 19-Jul-18

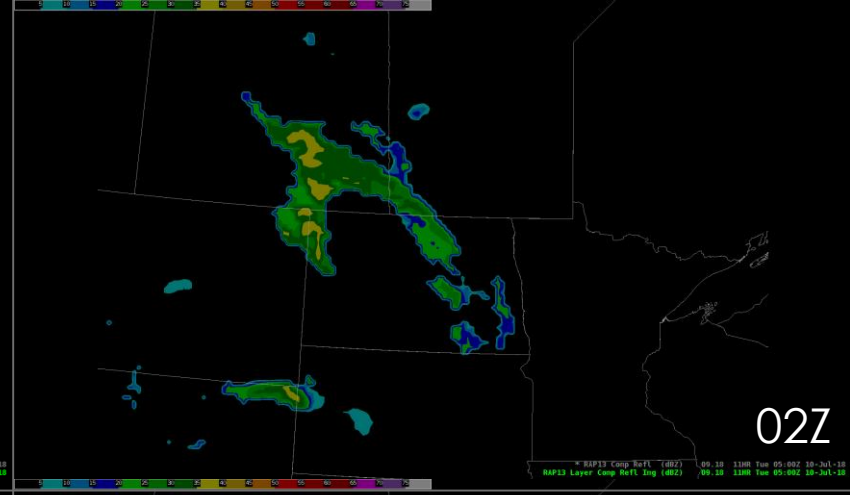

296 Cloud Flashes
3 + Strikes
83 - Strikes
1 Minute Cloud to Ground ENTLN Lightning Plot Thu 17:52Z 19-Jul-18
1 Minute Cloud Flash ENTLN Lightning Plot Thu 17:52Z 19-Jul-18
METAR Plot Thu 17:00Z 19-Jul-18
RAP13 0-3 km AGL Helicity (for > 300J/Kg MLCape) ()
RAP13 0-6 Km Agl Bulk Shear Vectors (kts)
RAP13 700MB-500MB Lapse Rate (C/km)
GOES-16 GLM Flash Extent Density (flashes/5min) (5min-1min update) Thu 17:52Z 19-Jul-18
*Day Cloud Phase Distinction (RGB): 10.35 µm/0.64 µm/1.61 µm Thu 17:52Z 19-Jul-18


543 Cloud Flashes
25 + Strikes
71 - Strikes
SVR PROB: 98%
Env MUCAPE: 4557 J/kg
Env EBShear: 67.5 kts
MRMS MESH: 0112Z 2.05 in.
Norm Vert Growth Rate: N/A
NOAA/CIMSS Prob Severe Model (%) Fri 01:12Z 29-Jun-18
1 Minute Cloud to Ground ENTLN Lightning Plot Fri 01:12Z 29-Jun-18
1 Minute Cloud Flash ENTLN Lightning Plot Fri 01:12Z 29-Jun-18
METAR Plot Fri 01:00Z 29-Jun-18
* VIS/IR Sandwich (RGB): goesrSandwichRed/goesrSandwichGreen/goesrSandwichBlue Fri 01:12Z 29-Jun-18

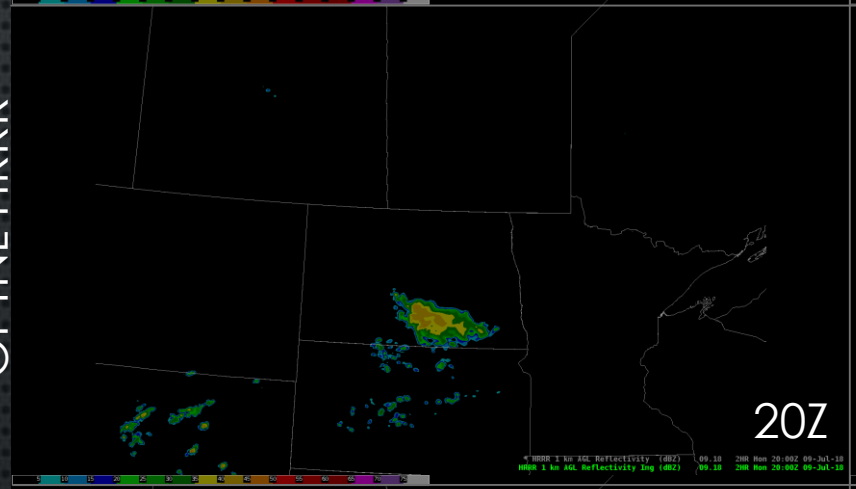
RAP13

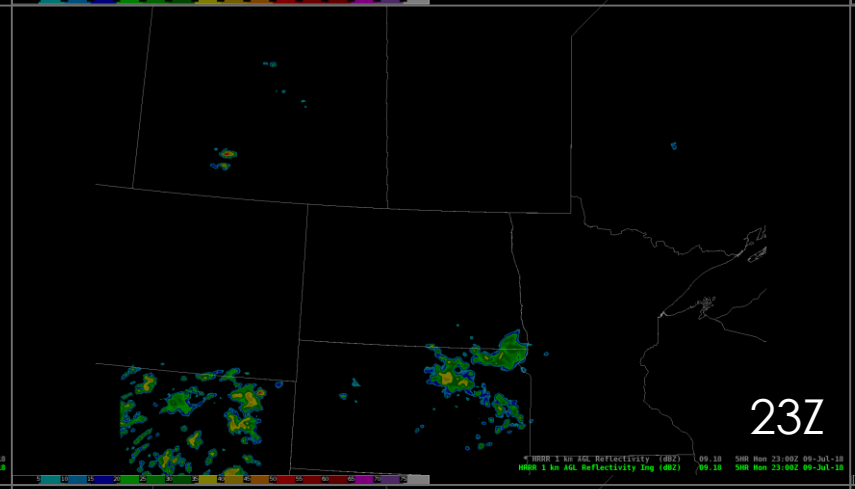


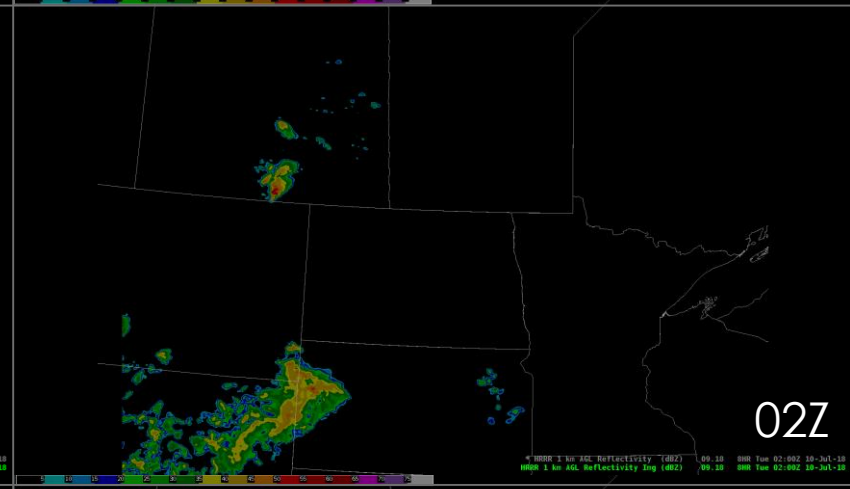




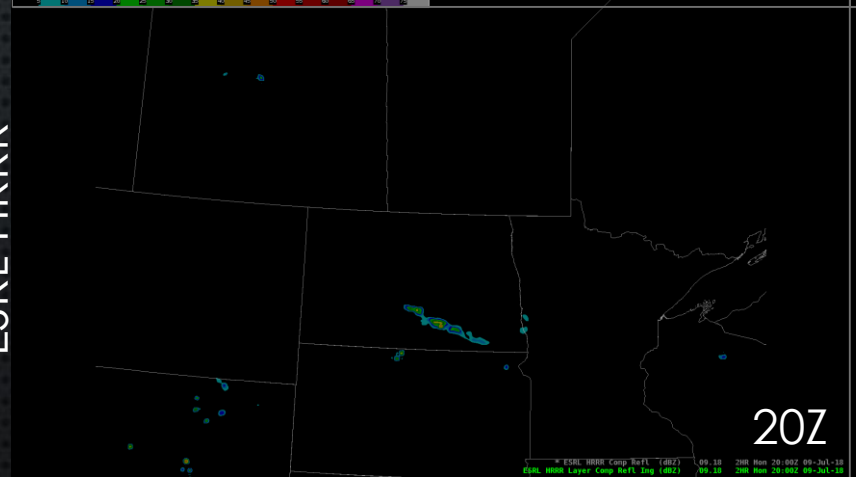
OPTNL HRRR

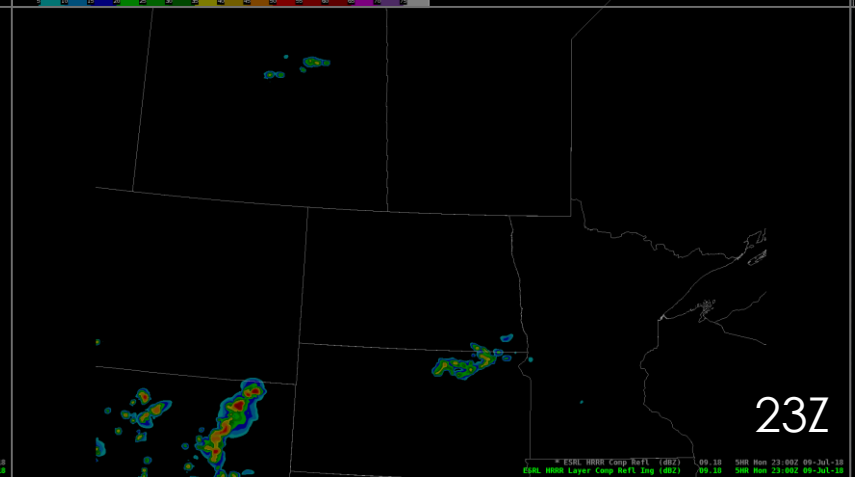


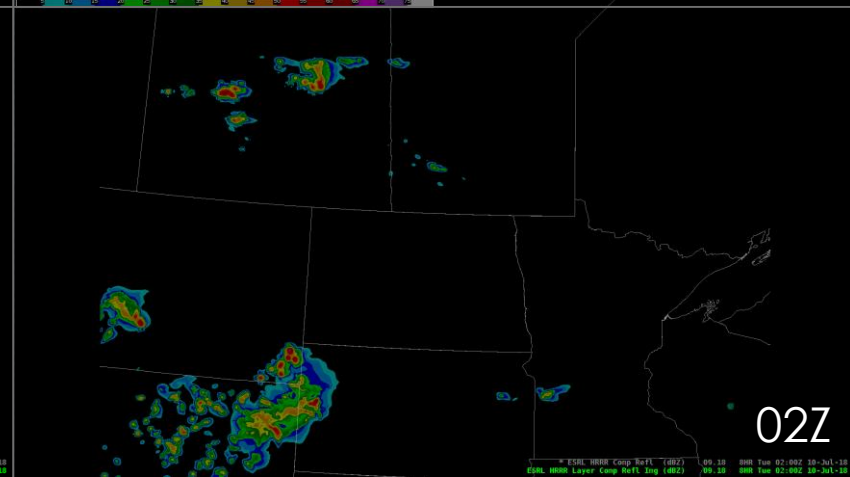




ESRL HRRR







IDSS EVENT

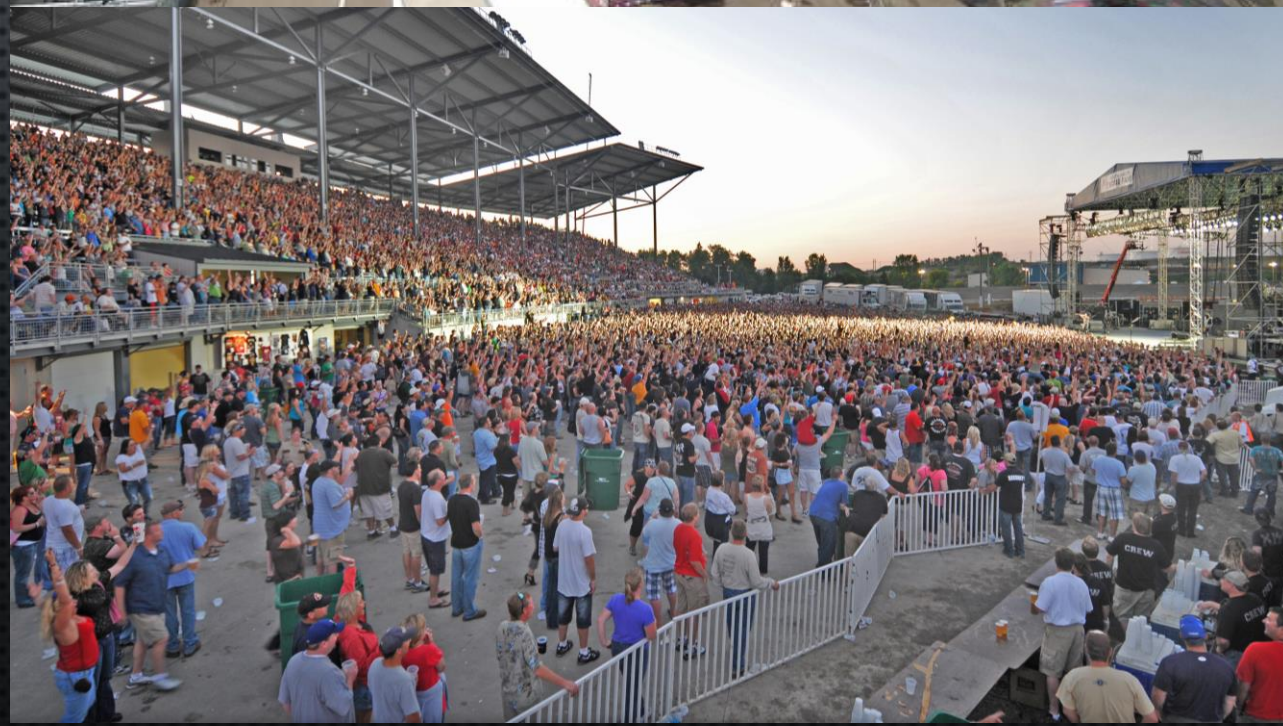
North Dakota State Fair
Williston, ND

EOC staffed 24/7 during the fair

Critical Weather Thresholds

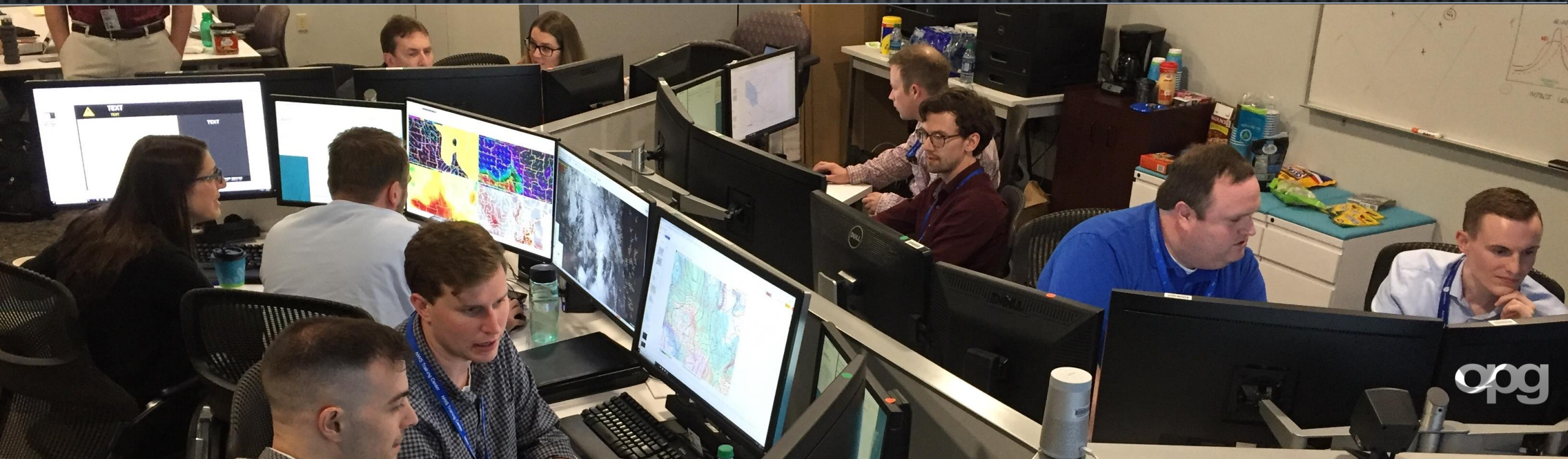
- 40+ mph wind
- Lightning
- Large hail
- Heavy rain

Need at least 30 minutes to execute safe sheltering procedures



Immersive Experience

- Hands-on, job-relevant, collaborative problem-solving exercises
- Connect the learning experience to improving job performance
- Evaluate viability of adopting a new paradigm in WFO operations
- Create a team of mesoanalysis specialists – field "ambassadors"



Immersive Experience

Spring/Summer 2019: 3 week-long proof-of-concept experiments

10 WFO forecaster participants per session *(+ SME, SPC, EM)*

Findings & Recommendations to NWS Leadership in October

Key Takeaways from Participant Surveys

- Forms the basis of an effective CFP for severe convective weather services
- Enhances situational awareness and threat assessment
- Facilitates continuous flow of information (FACETs paradigm)
- Most valuable in highly conditional threat scenarios
- Lends itself to synthesizing probabilistic information
- Significant knowledge/proficiency gap will need to be addressed

- Major mindset shift toward anticipating development rather than reacting to it
- Better prepared to predict CI, mode; and communicate associated threats
- Clarity on value of the meso role and its contribution to tactical IDSS
- Learned to think about, and message, a range of reasonable outcomes
- Experiential format and honest feedback accelerated learning
- Office culture of open communication critical to successful implementation

Ideas for Expanding the Reach

Ideas for Expanding the Reach

Experiential Training

- In-residence
- Road shows
- Practice on blue sky days
- Multi-office collab sims

Case study webinars, blogs…

(interrupt the cycle of forgetfulness)

Mutual Aid Teams

SOO Role - Lead and implement foundational science advancements upon which enhanced services are built.


BATES
ROWING